PASSAIC RIVER RESTORATION PROJECT

LOWER PASSAIC RIVER STUDY AREA RI/FS

COLLECTION OF SURFACE SEDIMENT SAMPLES CO-LOCATED WITH SMALL FORAGE FISH TISSUE SAMPLES ADDENDUM TO THE QUALITY ASSURANCE PROJECT PLAN

SURFACE SEDIMENT CHEMICAL ANALYSES AND BENTHIC INVERTEBRATE TOXICITY AND BIOACCUMULATION TESTING

DRAFT

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Revision Number: 0
Addendum Number 2

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Acronyms

CPG	Cooperating Parties Group
ERA	ecological risk assessment
LPRSA	Lower Passaic River Study Area
NJDEP	New Jersey Department of Environmental Protection
NJDOT	New Jersey Department of Transportation
NOAA	National Oceanic and Atmospheric Administration
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
QAPP	quality assurance project plan
RM	river mile
SOP	standard operating procedure
USACE	US Army Corps of Engineers
USEPA	US Environmental Protection Agency
USFWS	US Fish and Wildlife Service
Windward	Windward Environmental LLC

Introduction

This is an addendum to the *Lower Passaic River Restoration Project Quality Assurance Project Plan: Surface Sediment Chemical Analyses and Benthic Invertebrate Toxicity and Bioaccumulation Testing* (Windward 2009b), hereafter referred to as the Benthic Quality Assurance Project Plan (QAPP). The Benthic QAPP, which was reviewed by the US Environmental Protection Agency (USEPA) and its Partner Agencies[1] and approved by USEPA on October 8, 2009, describes the sampling effort and data use objectives for the surface sediment samples to be collected from the Lower Passaic River Study Area (LPRSA) to support the baseline ecological risk assessment (ERA) and the baseline human health risk assessment for the LPRSA. This addendum to the Benthic QAPP, hereafter referred to as Benthic QAPP Addendum No. 2, describes the collection of surface sediment samples for chemical analysis in order to fill a data need from the fall 2009 benthic field effort.

The Benthic QAPP (Windward 2009b) specified that a subset of the sampling locations proposed for the collection of small forage fish (i.e., mummichog and darter/killifish) during the late summer/early fall 2009 fish community survey (Windward 2009a) would be sampled for surface sediment. However, insufficient numbers of mummichog and darter/killifish were collected during the late summer/early fall 2009 field effort (Windward 2010a) to provide sufficient tissue for chemical analysis; therefore, the collection of co-located sediment samples was deferred until these fish could be caught. In order to address this data use objective, another fishing effort to collect small forage fish was conducted during late spring/early summer 2010; this fish tissue collection effort is described in the Fish/Decapod QAPP Addendum No. 4 (Windward 2010b).

During the late spring/early summer 2010 fishing effort, sufficient numbers of mummichog were caught at 10 locations to meet the minimum mass requirement for tissue analysis; insufficient numbers of darter/killifish or other freshwater small forage fish were caught for analysis. One more 3-day attempt will be made to catch small freshwater forage fish prior to the collection of co-located surface sediment samples. Surface sediment samples will be collected from locations where small forage fish were caught as part of the late spring/early summer 2010 fish community and tissue collection sampling effort; samples will be collected in conjunction with the summer 2010 benthic community survey, as described in the Benthic QAPP Addendum No. 1 (Windward 2010c), which will be conducted after the late spring/early summer 2010 fish tissue collection effort.

The Benthic QAPP Addendum No. 2 includes updates to worksheets relevant to the collection of sediment at locations where small forage fish were caught; this addendum does not include worksheets or attachments that are not relevant to this sampling event. Applicable and updated worksheets included in this addendum are presented below:

- Worksheet No. 1 contains the title and approval pages for the addendum.
- Worksheet No. 3 provides the distribution list.
- Worksheet No. 9 provides the summaries and participant lists for any project scoping sessions.

[1] The Partner Agencies include the US Army Corps of Engineers (USACE), New Jersey Department of Environmental Protection (NJDEP), New Jersey Department of Transportation (NJDOT), National Oceanic and Atmospheric Administration (NOAA), and the US Fish and Wildlife Service (USFWS).

- Worksheet No. 10 describes the specific problem definition for the collection of surface sediment at locations where small forage fish were caught.
- Worksheet No. 11 provides a summary of project tasks.
- Worksheet No. 18 provides the list of sampling locations where co-located sediment will be collected based on the locations where mummichog were caught during the late spring/early summer 2010 fish tissue collection effort. If small freshwater forage fish are caught prior to sediment collection, Worksheet No. 18 (and Figure 1) will be revised to include the locations for the collection of sediment samples co-located with the locations where small freshwater forage fish were caught.
- Attachment D is a revised standard operating procedure (SOP) for the collection and processing of sediment grab samples.

QAPP Worksheet No. 1. Title and Approval Page

Addendum to the *Quality Assurance Project Plan for Surface Sediment Chemical Analyses and Benthic Invertebrate Toxicity and Bioaccumulation Testing*

Document Title

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QAPP Worksheet No. 1. Title and Approval Page

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QAPP Worksheet No. 3. Distribution List

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QAPP Worksheet No. 3. Distribution List

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QAPP Worksheet No. 9. Project Scoping Session Participants Sheet

Project Name:	Lower Passaic River Restoration Project (LPRRP) Ecological and Human Health Risk Assessments
Site Name:	LPRSA
Projected Date(s) of Sampling:	August 2 – 6, 2010
Site Location:	LPRSA
Project Manager:	Bill Potter/Robert Law, de maximis, inc. (dmi)
Date of Session:	July 14, 2010
Scoping Session Purpose:	Conference call to discuss fish catch results from the late spring/early summer 2010 fish tissue collection effort

Participants: USEPA, dmi, CDM, Windward

Name	Affiliation	Phone No.	E-mail Address
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Conference Call to Discuss Catch Results from the Late Spring/Early Summer 2010 Fish Tissue Collection Effort

Purpose/ Decisions:

A conference call between USEPA and the Cooperating Parties Group (CPG) to discuss the results of the fish tissue collection effort during the late spring/early summer 2010 was held July 14, 2010.

USEPA believed that after completing 19 days of fishing during the late spring/early summer 2010, there was still a data need for small forage fish in freshwater reaches of the LPRSA (specifically, Reaches 4 through 7). It was agreed that the data needs for Reaches 4 through 7 had not been met. Mummichog were caught in sufficient numbers at 10 locations in Reaches 1 through 3 (River Mile [RM] 0 to RM 6) to provide tissue mass for the full suite of analytes. Few small forage fish were caught in the freshwater section of the LPRSA during the 19-day fishing effort conducted in late spring/early summer 2010. USEPA requested that CPG conduct an additional 3-day effort focused solely on the collection of small freshwater forage fish in Reaches 4 through 7 (RM 6 to RM 14).

Based on the discussion during the call, the following items were considered:

- USEPA proposes to conduct 3 additional days of fishing for small freshwater forage fish in Reaches 4 through 7.
- The additional 3-day effort will occur prior to the collection of co-located sediment so that if fish are caught in sufficient numbers to provide tissue for analysis, sediment will be collected during the summer benthic community survey.
- Chuck Nace, USEPA, will be on the sampling vessel for the 3 days of fishing and oversee the selection of fishing locations as well as specific fishing techniques that will be used.
- CPG will prepare a spreadsheet with the proposed mummichog tissue composite samples to send to USEPA for approval.

QAPP Worksheet No. 10. Problem Definition

The problem to be addressed by the project:
The collection of surface sediment samples at locations where small forage fish were caught is intended to support the LPRSA ERA. As discussed in the Benthic QAPP (Windward 2009b) and the Fish/Decapod QAPP (Windward 2009a), the co-located sediment chemistry data will be evaluated in conjunction with tissue chemical concentrations to determine whether there is a statistical relationship between chemical concentrations in small forage fish tissue and surface sediment.
The rationale for sample location:
The final locations for the collection of surface sediment samples are based on locations where small forage fish were caught during the late spring/early summer 2010 in sufficient quantity to analyze tissue samples.
Project decision conditions:
The conditions for project decisions (i.e., those decisions that may require communication between the CPG and USEPA during the field event) include the need to adjust sampling methods (e.g., sample by hand if the locations are inaccessible by boat) and/or the need to delay or suspend sampling because of hazardous weather conditions. The CPG will immediately suspend operations under conditions of extreme weather and/or environmental conditions that are a threat to worker health and safety.

QAPP Worksheet No. 11. Project Quality Objectives/Systematic Planning Process Statements

What will the data be used for?
The data collected during this effort will be used in the ERA as specified in Worksheet No. 11 of the Benthic QAPP (Windward 2009b) and in conjunction with tissue chemical concentrations from small forage fish to determine whether there is a statistical relationship between chemical concentrations in small forage fish tissue and surface sediment.
What types of data are needed?
Surface sediment samples collected during this effort will be analyzed for polychlorinated biphenyl (PCB) congeners (and homologs), PCB Aroclors, polychlorinated dibenzo-*p*-dioxins/polychlorinated dibenzofurans, organochlorine pesticides, polycyclic aromatic hydrocarbons (PAHs), alkylated PAHs, metals (including total mercury, methylmercury, and butyltins), semivolatile organic compounds (including phthalates), volatile organic compounds, total petroleum hydrocarbons (extractable, purgeable, and alkanes), herbicides, sulfide, ammonia-N, cyanide, total phosphorus, total Kjeldahl nitrogen, acid volatile sulfide/simultaneously extracted metals, percent moisture, grain size, and total organic carbon.
Matrix
Chemical analysis will be conducted on surface (0 to 15 cm [0 to 6 in.]) sediment samples.
How "good" do the data need to be in order to support the environmental decision?
The quality of data obtained through this effort will meet the surface sediment data goals detailed in the Benthic QAPP (Windward 2009b). Specifically, the project quantitation limit goals established for these analyses are provided in Worksheet No. 15 of the Benthic QAPP. Other analytical performance criteria, such as precision, accuracy, and completeness requirements, for the chemical analyses are presented in Worksheet Nos. 12 and 28 of the Benthic QAPP.
How many data are needed?
Surface sediment samples will be collected from the 10 locations (as illustrated on Figure 1) where mummichog were caught during the late spring/early summer 2010 fish tissue collection effort in sufficient quantity to meet the minimum mass requirements for the full suite of analytes established in the Fish/Decapod QAPP (Windward 2009a). The number of additional sediment samples (in

QAPP Worksheet No. 11. Project Quality Objectives/Systematic Planning Process Statements

additional to the 10 locations presented in Figure 1 and listed in Worksheet No, 18) to be collected as part of the field effort in the summer 2010 will depend on the number of locations where small freshwater forage fish are caught prior to sediment sampling.[2]

Where, when, and how should the data be collected/generated?

Where should the data be collected?

Surface sediment samples will be collected at locations where mummichog were caught during the late spring/early summer 2010 fish tissue collection effort in sufficient quantity to meet the minimum mass requirements for tissue analysis. The target sediment sampling locations are presented in Worksheet No. 18 and Figure 1 of this addendum. If small freshwater forage fish are caught prior to sediment collection, surface sediment samples will be collected at locations where sufficient tissue mass is available for analysis. Worksheet No. 18 (and Figure 1) will be revised to include these new locations.

Consistent with the methods outlined in the Benthic QAPP (Windward 2009b) for the collection of chemistry-only samples, a total of five grab subsamples will be collected from within each target location area where fish were caught and then composited into one sample. The target co-located sediment sampling locations in Worksheet No. 18 are represented as locations where small forage fish (i.e., mummichog) were caught in sufficient mass for chemistry analysis during the late spring/early summer 2010 fishing effort. The five grab subsamples will be selected to represent trap locations and cast net areas where fish were caught.

When should the data be collected?

Surface sediment samples will be collected in conjunction with the summer 2010 benthic community survey described in the Benthic QAPP Addendum No. 1 (Windward 2010c).

How should the data be collected?

Methods used to collect samples will follow the SOPs detailed in the revised Attachment D: SOP—Collection and Processing of Sediment Grab Samples, which is attached to this addendum. A total of three grab subsamples will be collected within the target area where small forage fish were caught and composited into one sample.

[2] Per USEPA request, a 3-day fish tissue sampling effort from RM 6 to RM 14 will be conducted concurrent with the start of the summer 2010 benthic sediment sampling effort to determine whether additional forage fish can be collected. If additional forage fish are collected in sufficient mass for tissue analysis, additional co-located sediment locations will be sampled.

QAPP Worksheet No. 11. Project Quality Objectives/Systematic Planning Process Statements

Who will collect and generate the data?
Windward will provide the field sampling coordination and most of the field personnel required to conduct the collection of surface sediments described in this Benthic QAPP addendum No. 2. Windward will be supported by its contractors Gravity Consulting, Inc., and Aqua Survey, Inc., as well as de maximis, inc., and AECOM field personnel, as required.
How will the data be reported?
Updates will be communicated (e.g., via telephone conversation, e-mail) to CPG project managers and project coordinators. An electronic database that includes the coordinates of sediment sampling locations and sediment sample characteristics will be provided at the end of the sampling effort. Preliminary data will be available upon request. Final electronic data submittals will be in the most recent USEPA Region 2 multimedia electronic data deliverable format as provided on the USEPA website. A data summary report that presents the results of chemical analyses for the surfaced sediment will be provided within 90 working days after the receipt of validated laboratory data. The data summary report will detail any modifications to the proposed sampling plan outlined in this Benthic QAPP Addendum No. 2.
How will the data be archived?
Data records, forms, and notes will be scanned and stored electronically in a project file. Hard copies will be archived at Windward's main office in Seattle, Washington. Similarly, once the data reports have been issued, they will be archived electronically and as hard copies.

QAPP Worksheet No. 18. Sampling Locations for the Co-Located Surface Sediment Collection Effort

Sampling Location[a]	Easting (X)[b, c]	Northing (Y)[b, c]	Bank	Approximate RM	Method	Analyses	Description and Rationale for Sampling Location[d]
LPRC2A	597384	690378	West	1.25	Grab sampler	Sediment chemistry	Co-located with mummichog tissue sampling location LPR1D
LPRC2B	597923	693052	West	1.8	Grab sampler	Sediment chemistry	Co-located with mummichog tissue sampling location LPR1DD
LPRC3A	596881	695081	West	2.3	Grab sampler	Sediment chemistry	Co-located with mummichog tissue sampling location LPR2B
LPRC3B	596206	695242	West	2.5	Grab sampler	Sediment chemistry	Co-located with mummichog tissue sampling location LPR2AA
LPRC4A	592574	695409	East	3.2	Grab sampler	Sediment chemistry	Co-located with mummichog tissue sampling location LPR2G
LPRC4B	590919	694289	East	3.6	Grab sampler	Sediment chemistry	Co-located with mummichog tissue sampling location LPR2CC
LPRC4C	590760	693998	East	3.7	Grab sampler	Sediment chemistry	Co-located with mummichog tissue sampling location LPR2OO
LPRC4D	590144	692952	East	3.8	Grab sampler	Sediment chemistry	Co-located with mummichog tissue sampling location LPR2E
LPRC5A	588627	692667	East	4.2	Grab sampler	Sediment chemistry	Co-located with mummichog tissue sampling location LPR3A
LPRC5B	5877798	692613	East	4.4	Grab sampler	Sediment chemistry	Co-located with mummichog tissue sampling location LPR3FF

[a] Additional sampling locations will be identified if small freshwater forage fish are caught prior to sediment collection, Surface sediment samples will be collected at locations where sufficient tissue mass is available for analysis.

[b] New Jersey State Plane, North American Datum 83 (US survey ft).

[c] GPS coordinates have not been differentially corrected. The final coordinates will be differentially corrected prior to initiating field work.

[d] Surface sediment samples will be collected at locations where small forage fish (i.e., mummichog) were caught in sufficient mass for chemistry analysis during the late spring/early summer 2010 fishing effort. A total of three grab subsamples will be collected within each target area where fish were caught and then composited into one sample.

GPS – global positioning system
QAPP – quality assurance project plan
RM – river mile

References

Windward. 2009a. Lower Passaic River Restoration Project. Lower Passaic River Study Area RI/FS. Quality Assurance Project Plan: Fish and decapod crustacean tissue collection for chemical analysis and fish community survey. Final. Prepared for Cooperating Parties Group, Newark, New Jersey. Windward Environmental LLC, Seattle, WA.

Windward. 2009b. Lower Passaic River Restoration Project. Lower Passaic River Study Area RI/FS. Quality Assurance Project Plan: Surface sediment chemical analyses and benthic invertebrate toxicity and bioaccumulation testing. Final. Prepared for Cooperating Parties Group, Newark, New Jersey. Windward Environmental LLC, Seattle, WA.

Windward. 2010a. Lower Passaic River Restoration Project. Fish and decapod field report for the late summer/early fall 2009 field effort. Draft. Prepared for the Cooperating Parties Group, Newark, NJ. Windward Environmental LLC, Seattle, WA.

Windward. 2010b. Lower Passaic River Restoration Project. Lower Passaic River Study Area RI/FS. Late spring/early summer 2010 fish tissue collection. Addendum to the Quality Assurance Project Plan: Fish and decapod crustacean tissue collection for chemical analysis and fish community survey. Addendum No. 4. Final. Prepared for Cooperating Parties Group, Newark, New Jersey. June 21, 2010. Windward Environmental LLC, Seattle, WA.

Windward. 2010c. Lower Passaic River Restoration Project. Lower Passaic River Study Area RI/FS. Spring and summer 2010 benthic invertebrate community surveys. Addendum to the Quality Assurance Project Plan: Surface sediment chemical analyses and benthic invertebrate toxicity and bioaccumulation testing. Final. Prepared for Cooperating Parties Group, Newark, New Jersey. Submitted to USEPA on May 17, 2010. Windward Environmental LLC, Seattle, WA.

Attachment D: SOP—Collection and Processing of Sediment Grab Samples (Revision 2, dated July 23, 2010)

I. Purpose

A. This standard operating procedure (SOP) describes the collection and processing of sediment grab samples for the Lower Passaic River Restoration Project and is based on SOP 34 of the field sampling plan (Malcolm Pirnie et al. 2006). Grab samples will be collected for chemical, toxicological, and biological (i.e., benthic community) analyses as well as analysis of tissue from laboratory-based bioaccumulation testing.

II. Definitions

A. No specific terms have been identified as requiring definitions.

III. Supplies and Equipment

The following are needed to collect sediment grab samples:

1. Grab sampler (type will depend on river bottom conditions and sampling needs): a 0.2-m^2 power grab or a 0.5-m^2 Ponar grab (for the upper reaches of the LPRSA). Examples of grab samplers covered by the SOP include: Young-modified van Veen, van Veen, Smith-McIntyre, Eckman, Shipek, and Petersen.
2. Extra weights for the grab sampler
3. Sampling vessel, with a fathometer, capable of deploying grab apparatus with sufficient room for all aspects of grab sampling (e.g., homogenization, sieving, cleaning). Sufficient room must also be available for the storage of collected samples
4. Appropriate winch and cable to deploy grab sampler in deep waters
5. Wooden base or stand for grab sampler
6. Bucket with pour spout
7. 2.54-cm-diameter syringe
8. Sieve table with tube
9. Sieves, mesh size 0.5 mm and 1 mm
10. Sample containers: plastic wide-mouth jars in various sizes for infauna, glass or plastic jars with Teflon®-lined screw caps for chemistry and grain size, or as specified in the *Lower Passaic River Restoration Project. Lower Passaic River Study Area RI/FS. Quality Assurance Project Plan: Surface Sediment Chemical Analyses and Benthic Invertebrate Toxicity and Bioaccumulation Testing,* hereafter referred to as the Benthic Quality Assurance Project Plan (QAPP) (Windward 2009)
11. Squirt bottles
12. Funnels
13. Tape: electrical and Teflon® tape for sealing sample jar lids, and clear packing tape for securing/protecting the computer-generated barcode labels

14. Pencils
15. Plastic ruler
16. Reagents

    37 to 40% solution of formaldehyde (100% formalin)

    Borax (to buffer the formalin)
17. Solvents for cleaning equipment between stations and other sampling equipment as listed in Attachment E of the Benthic QAPP (Windward 2009): SOP—Procedure to Decontaminate Sampling Equipment (Section III)
18. Personal protective equipment (PPE)
19. Weighted demarcated line
20. Refractometer
21. Stainless steel spoons and large plastic scoops (for hand-sampling)
22. Receptacles for homogenizing and composite collection

IV. Procedures

A. Collection of Benthic Sediment Samples Using Grab Samplers

1. Samples should be collected upstream from the boat's engine or any other machinery that may release exhaust, fumes, or oil into the sample. Once the vessel is at the sampling station, all engines should be turned off. The boat captain, or designee, will determine the depth of the sampling station using a fathometer (or weighted demarcated line). If the sampling stations are located within a short distance of each other, then the most downstream sample, considering the tide, should be collected first to avoid contamination from disturbance and resuspension of sediment due to sampling activities. Sampling in areas of aquatic vegetation, where macrophyte roots or other vegetation might inhibit sample collection, should be avoided, unless sediment target location is a co-located sample (i.e., co-located with fish sample). Station coordinates will be manually recorded on the station log. The sampler must be thoroughly washed with Alconox™ prior to use at a station, then rinsed with ambient water to ensure that no sediments remain from the previous station. As stated in Worksheet No. 11 of the Benthic QAPP (Windward 2009), the following water quality parameters will be measured in the field: temperature, dissolved oxygen, salinity, conductivity, and pH (see Attachment P to the Benthic QAPP for water quality sampling methods).
2. Attach the sampler to the end of the winch cable with a shackle and tighten the pin.
3. Adjust the weight of the grab sampler according to the substrate (i.e., soft bottom – few/no weights; hard bottom – multiple weights). Set the grab sampler according to the manufacturer's instructions.
4. Once the grab sampler is cocked, lower it into the water column such that travel through the last 5 m is no faster than about 1 m/sec. This minimizes the dispersal of fine material due to a sampler-induced shock wave. Do not allow the grab sampler to free fall into the substrate. In shallow waters, some grab samplers can

be pushed directly into the sediment with a minimum penetration of 6 inches; care must be taken to not overfill the sampling apparatus. For example, 5- and 10-foot extension handles can be attached to Eckman grabs for sampling in shallow waters.

5. When the cable goes slack, the grab sampler is on the bottom. Initiate recovery slowly, until the grab sampler is free from the bottom. After that, retrieve the cable at a steady rate, until the grab sampler is visible near the surface. When the grab sampler is visible, slow the rate of ascent so that it can be steadied as it is brought on board. If an insufficient or improper sample is collected, additional weights should be added to the sampler to allow deeper penetration into the sediment. Set the sampler on the wooden stand, open the lid and inspect the sample for acceptability. An acceptable grab is one that displays the following characteristics:
    a. The power grab has penetrated a minimum of 15 cm (6 inches). Note that this minimum penetration depth may be greater than the biological active zone.
    b. Sampler is not overfilled with sediment, the jaws are fully closed, and the top of the sediment is below the level of the open doors.
    c. The overlying water is not excessively turbid.
    d. The sampler is at least half full, indicating that the desired penetration has been achieved.
    e. The sediment is level on at least one side.
6. In certain locations, slight over-penetration may be acceptable, at the discretion of the field coordinator (FC). The FC will make the final decision regarding acceptability of all grab samples. The overall condition of the grab sample (i.e., “slightly sloped on one side”) should be noted in the field application. This information will be the same as the information required on the Surface Sediment Collection Form (Figure 1).
7. Carefully drain overlying water from the grab sample (through the use of a siphon tube). If the grab sample is used for benthic community analysis, the water must be drained into the container that will receive the sediment to ensure no organisms are lost.
8. Record all grab samples taken on the station log. If the grab sample is rejected, record the reasons on the Surface Sediment Collection Form (Figure 1), along with other pertinent station information.
9. If the sample is rejected, empty the grab sampler, placing the discarded sediment into an appropriately labeled waste container (see Attachment F to the Benthic QAPP (Windward 2009): SOP–Management and Disposal of Investigation-Derived Waste), then wash the grab sampler thoroughly with seawater and re-cock the sampler. Note that decontamination cleaning procedures are not required when the grab sampler is redeployed at the same sampling station. The sampling procedure is repeated until an acceptable grab sample is obtained.

B. Collection of Intertidal Benthic Sediment Samples By Hand

1. In the event that target intertidal sediment sampling locations cannot be accessed by boat, sediment will be collected by hand. The field crew will access the

exposed target sampling location by boat or from land during low tide. Station coordinates will be manually recorded on the station log. Stainless steel spoons must be thoroughly washed with Alconox™ prior to use at a station, then rinsed with ambient water.

2. Using decontaminated stainless steel spoons, collect exposed intertidal sediments to a depth of 15 cm (6 inches). Place sediment into sample containers (see Section VI for methods on the collection of sediment samples).
3. Record all samples taken on the station log.

C. Collection of Subtidal Benthic Sediment Samples By Hand

1. In the event that sediments at target subtidal sampling locations cannot be sampled using a grab sampler, sediments will be collected by hand. The field crew will access the submerged target sampling location by boat or from land during low tide. Station coordinates will be manually recorded on the station log. Stainless steel spoons must be thoroughly washed with Alconox™ prior to use at a station, then rinsed with ambient water.
2. Using two decontaminated plastic scoops, collect submerged sediment in an action similar to the jaws of a grab sampler (e.g., Eckman grab sampler). The plastic scoop sample must be cohesive to be considered an acceptable sample (i.e., sample physical integrity must remain intact where no loss of fine material is observed).
3. Using a decontaminated stainless steel spoon, transfer sediment that is not directly in contact with the plastic scoops to a depth of 15 cm (6 inches) into sample containers, ensuring that no sediment touching the scoops is collected.
4. Record all samples taken on the station log.

V. Decontamination Cleaning Procedures

A. Sediment collection for non-chemistry (e.g., infaunal) analysis requires that the grab sampler or sampling equipment (i.e., stainless steel spoons) be cleaned with at least soap and water between stations. For samples collected for chemical analyses, follow the cleaning procedures in Attachment E to the Benthic QAPP (Windward 2009): SOP—Procedure to Decontaminate Sampling Equipment.

Note that all solvents and discarded sediments must be captured and disposed of inappropriately labeled waste containers (see Attachment F to the Benthic QAPP (Windward 2009): SOP—Management and Disposal Investigation-Derived Waste). All instruments that come into contact with the sample (i.e., syringe, ruler, collection buckets) must be cleaned in the same manner as the grab sampler.

VI. Collection of Sediment Sample

A. General

1. Once the sample is deemed acceptable, processing can begin. Measure the penetration depth of the grab sampler by inserting a clean ruler into the sediment near the center of the sample. Record the depth and corresponding volume on the Surface Sediment Collection Form (Figure 1). It is important that all sediment be retained if the grab sample is collected for infaunal analysis. If the grab sample

is going to be analyzed for infauna, then the ruler should be rinsed over the grab so that all of the adhering sediment washes back into the sample.

2. An estimate of the apparent redox potential discontinuity will be made. Insert a 2.54-cm-diameter syringe into the sediment and withdraw a core. Estimate the distance from the surface of the sediment to the upper portion of the black subsurface sediment (if visible) to the nearest 0.5 cm and record the distance on the Surface Sediment Collection Form (Figure 1). If the grab sample is collected for infaunal analysis, the contents of the syringe and all adhering sediment must be washed back into the sample as described above. For all other analyses, the core may be properly disposed.
3. Measure the interstitial salinity using the procedures described in Attachment N to the Benthic QAPP (Windward 2009).

B. Chemical, Sediment Toxicity, and Bioaccumulation Samples

1. Sediment is collected from the top 15 cm (6 inches) for chemical, sediment toxicity, and bioaccumulation analysis. Once the grab has been deemed acceptable, the following chemistry samples will be collected first as discrete grabs, prior to homogenization by using a contaminant-free utensil: AVS-SEM, volatile organic compounds (VOCs[3]), TPH-purgeables, sulfides, and ammonia.
    a. Fill sample containers for AVS/SEM, sulfide, and ammonia, completely, leaving no headspace. Place the sediment for the sulfide analysis in a sample container with NaOH/zinc acetate preservative. Place the sediment for the AVS/SEM and ammonia analysis in a sample container with no preservative. Ensure that all containers are tightly capped. Store sample jars for AVS/SEM, sulfide, and ammonia at 4 ± 2 °C.
    b. Sample containers for VOCs and TPH-purgeables are pre-preserved and pre-weighed by Alpha Analytical. Alpha Analytical also provides a plastic syringe to collect the appropriate mass of sediment to maintain a 1:1 ratio of sediment to preservative. Use the plunger in the syringe and/or a contaminant-free utensil to fill the syringe with the sediment from the first acceptable grab. Once the syringe is full to 5 mL, transfer the sediment from the syringe to the appropriate sample container. The sediment sample should be completely immersed in preservative.
    c. For TPH-purgeables, fill one syringe to 5 mL and transfer the sediment to a container preserved with 5 mL of methanol. For VOCs, collect three syringes to 5 mL and place 5 mL in each of the 3 containers designated for VOCs (one preserved with 5 mL methanol, and two containers each preserved with 5 mL deionized water). Ensure that all containers are tightly capped. Fill one sample container with unhomogenized sediment for dry weight determination. Sample containers for VOCs and TPH-purgeables (and associated dry weight) must be stored at 4 ± 2 °C. The containers preserved with deionized water for VOC analysis must be frozen within 48 hours of collection.

[3] VOCs will only be collected from human health and SQT shallow sampling locations.

d. For hand-collected intertidal samples, collect sediments for VOC analysis at designated locations by pushing the syringe directly into the intertidal exposed sediments.

e. For hand-collected subtidal samples, collect sediments for VOC analysis at designated locations by pushing the syringe directly into the undisturbed surface sediment layer in the plastic scoop sample.

2. Once the chemistry samples that require minimal disturbance have been removed, place the remaining sediment in a clean receptacle. Additional acceptable grab samples will be collected to meet the following sediment volume requirements for the different analyses: toxicity tests 8 L (2 gallons), chemistry 5.7 L (1.5 gallons), freshwater bioaccumulation test 64.3 L (17 gallons), and estuarine bioaccumulation test 30 L (8 gallons). The number of grab samples collected for the composite will be recorded. From each acceptable grab the top 15 cm (6 inches) will be collected and placed in one or more clean receptacles. When sufficient sediment has been collected at a station the receptacles are transported to the field laboratory for processing. Worksheet No. 18 in Benthic QAPP Addendum No. 2 lists the different sampling stations and the analytical requirements.

3. Upon arrival at the field laboratory combine the contents from each receptacle into one and gently homogenize the sediment for 1 to 2 minutes with a mixer. Following homogenization, partition the sediment into the appropriate sample containers and in the amount specified by the selected laboratory. At the SQT sampling locations, 8 L [2 gallons] are needed for bioassay, and 5.7 L [1.5 gallons] are needed for chemistry; at the bioaccumulation stations, 64.3 L [17 gallons] are needed for the freshwater bioaccumulation test, and 30 L [8 gallons] are needed for the marine bioaccumulation test, based on 115 g of tissue per station. Samples to be analyzed for TOC, organic contaminants, and trace metals can be frozen immediately. Grain size samples should be refrigerated at 4 ±2 °C, not frozen.

C. Infaunal Sample Processing

1. The following procedures are used to collect sediment for infaunal samples.

a. For sediment collected using a grab sampler, four benthic community replicate samples are collected from four acceptable grabs at each location. At estuarine or freshwater locations a 0.1 m^2 or 0.5 m^2 frame is placed within the power grab and the sediment within the frame is collected to a depth of 15 cm (6 inches). All sediment within the frame must be retained, paying particular attention to organisms visible in overlying water or stuck to the sides of the frame. Transfer the entire frame sample into a clean collection bucket and transport the bucket to the field laboratory for further processing.

In order to collect the required volume of sediment for taxonomy analysis, separate frames fabricated for freshwater samples and marine samples will be utilized. The frames are intended to be pressed into the sediment while the sediment is still in the power grab. The sediment within the frame is to be collected for the sample. The frame for the marine samples measures 10.5 inches x 14 inches with a 15 cm (6 inch) penetration depth. The frame for the freshwater samples measures 9 inches x 9 inches with a 15 cm (6 inch)

penetration depth. In the event that the pneumatic power grab sampler does not allow for the insertion of the prefabricated sediment frame, the field team will use a smaller frame that fits into power grab sampler as many times as needed to collect the target sediment volume (e.g., the freshwater frame can be used to estimate the volume needed for marine community samples if the marine frame does not fit in the power grab).

b. For sediment collected by hand from intertidal locations, collect sediment using stainless steel spoons. Scoop surface sediment from the top 15 cm (6 inches) over the area (as defined by the appropriate marine or freshwater frame specified above) required to collect the target sediment volume and place sediment into sample containers.

c. For sediment collected by hand from subtidal locations, collect sediment using plastic scoops. Scoop surface sediment from the top 15 cm (6 inches) over the area (as defined by the appropriate marine or freshwater frame specified above) required to collect the target sediment volume and place sediment into sample containers.

2. In the field laboratory place the contents of the bucket in the sieve in the water filled tube on the sieving table. Use a 1 mm sieve for the estuarine samples and a 0.5-mm sieve for the freshwater samples.

3. Gently remove the sediment by moving the sieve up and down in the tube. If the sample volume is large sieve the sample in several rounds by placing a portion of the sediment in the sieve. Continue this process until the bucket is empty. While sieving, it is important to make sure that the remaining sediment in the bucket is covered with water to prevent it from drying out.

4. The portion of the sample remaining on the screen after sieving is retained for analysis. Wash the contents of the screen to one side of the sieve and place a funnel in an appropriately sized sample container or containers (the sample material should ideally fill ½ to ¾ of the container) and carefully wash the sample through the funnel into the sample container with water. Be sure to rinse the funnel and to cap the jar to prevent loss from spilling. Continue this process until the bucket is empty.

5. Once the entire sample has been sieved and collected in the sample jar, add buffered formalin to obtain a final concentration of 10% formalin (e.g., 100 mL of 37% formaldehyde in a 1-L container), and fill the jar to the threads with water. A heaping tablespoon of Borax should be added to the sample to ensure adequate buffering of the slightly acidic formalin. Gently swirl the contents of the jar to ensure complete mixing of the sample and the formalin. Affix the sample label and cover it with clear packing tape. Seal the jar tightly and tape the lid with Teflon® and/or electrical tape to prevent leakage and the escape of fumes during transport.

6. If the sample is made up of heavy material that will not wash through the sieve (i.e., course sand, rocks, and shell hash), it may be necessary to modify the sieving scheme to avoid injuring the organisms. This is accomplished by an elutriation procedure. The contents of the bucket are flooded with site water and gently swirled to encourage the small infaunal organisms to float to the top. The elutrient is then poured off onto the screen. The procedure is repeated until

organisms are no longer visible in the elutrient. The portion of the sample retained on the screen is referred to as the light-density fraction; the portion remaining in the bucket is the heavy-density fraction. The two fractions are rinsed into separate, labeled sample jars. Whenever a sample is divided into more than one jar, for any reason, the jar label must reflect the number of jars. The number of jars should also be noted on the chain-of-custody (COC) form.

VII. Quality Control

A. Field duplicates and equipment blanks for chemistry analysis will be collected at the frequencies described in Worksheet No. 20 of the Benthic QAPP (Windward 2009).

B. Any deviations from this SOP must be documented on the station log in the field logbook. Careful attention to the procedures described in this SOP by trained, qualified personnel will ensure the quality of the samples collected.

C. Interferences that may be encountered during sediment sampling using grab devices should be recorded, and every attempt should be made to minimize their impacts. Such interferences include:

1. Shallow depth of penetration
2. Shock wave and loss of very fine-grained surface deposits
3. Potential for water column contamination and nearby down-current sediment redeposition
4. Loss of depth profile
5. Difficulty of sampling in high current waters
6. Large debris materials such as twigs and stones that may prevent the closure of grab

VIII. References

Malcolm Pirnie, Earth Tech, Battelle. 2006. Lower Passaic River Restoration Project. Draft field sampling plan. Volume 2. Prepared for US Environmental Protection Agency, US Army Corps of Engineers, and New Jersey Department of Transportation/Office of Maritime Resources. Malcolm Pirnie, Inc., White Plains, NY; Earth Tech, Inc., Bloomfield, NJ; Battelle, Stony Brook, NY.

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Prepared for Cooperating Parties Group, Newark, New Jersey. Windward Environmental LLC, Seattle, WA

SURFACE SEDIMENT COLLECTION FORM

Project Name: _____ **Project no.:** _____

Date: _____ **Weather:** _____

Sampling Method: _____ **Crew:** _____

GRAB DATA	**Location ID:**				
Latitude/Northing(Y):			**Longitude/Easting(X):**		
Grab time	**Bottom depth (m)**	**Penetration depth (cm)**	**Acceptable grab (Y/N)**	**Benthic Community Subsample ID**	**Comments:**
SAMPLE DATA	**Sample ID:**				
Analyses needed before homogenization (circle): VOC sulfides AVS/SEM Other:					

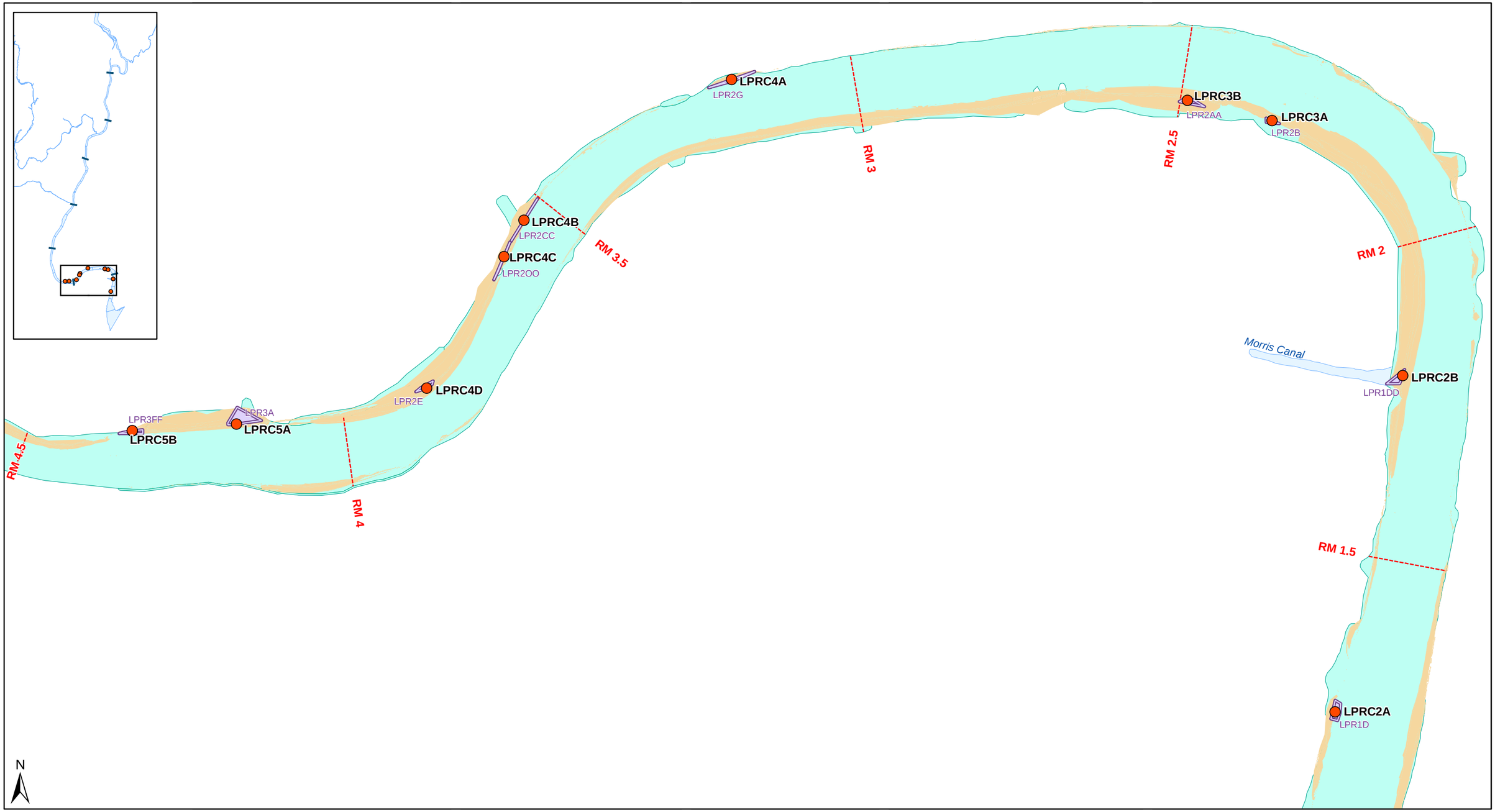
Sediment type	**Sediment color**	**Sediment odor**		**Comments:** (i.e. redox potential discontinuity, organic matter, wood debris, shell fragments, sheen, fauna, field duplicate, rinsate blank, etc.)
cobble	brown surface	none	H_2S	
gravel	drab olive	slight	petroleum	
sand (F M C)	brown	moderate	other:	
silt	gray	strong		
clay	black			

GRAB DATA	**Location ID:**			
Latitude/Northing(Y):			**Longitude/Easting(X):**	
Grab time	**Bottom depth (m)**	**Penetration depth (cm)**	**Acceptable grab (Y/N)**	**Comments:**
SAMPLE DATA	**Sample ID:**			
Analyses needed before homogenization (circle): VOC sulfides AVS/SEM Other:				

Sediment type	**Sediment color**	**Sediment odor**		**Comments:** (i.e. redox potential discontinuity, organic matter, wood debris, shell fragments, sheen, fauna, field duplicate, rinsate blank, etc.)
cobble	brown surface	none	H_2S	
gravel	drab olive	slight	petroleum	
sand (F M C)	brown	moderate	other:	
silt	gray	strong		
clay	black			

Figure 1: Surface Sediment Collection Form

Oversize Figure



0 0.5 Kilometers

0 0.25 Miles

- Colocated sediment
- Approximate late spring/ early summer 2010 fish sampling area*
- Mudflat or gravel flat
- River mile
- LPRSA
  - Estuarine river section
  - Upper Passaic River or tributary

*Area represented by cast-net area and/or trap locations where fish were caught.

Mudflat and gravel flat locations are determined as those areas where the river bottom slope is ≤6° and the depth is ≥-4.5 ft NGVD29 (i.e. -2 ft ft MLLW). LPRSA bathymetry is taken from the 2007 bathymetric survey conducted by Gahagan & Bryant Associates, Inc. (GBA), except for the area outside Kearny Point; bathymetry in the southeast part of this area is estimated based on NOAA data. In the GBA survey area, multibeam data are used where available and single-beam data are used where they are not.

Figure 1. Sampling locations for the co-located surface sediment collection effort

DRAFT

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